

In the Claims:

1. (Currently amended) A light transforming device having a graded index of refraction, comprising:

a body made substantially of a first amorphous material,

the body having embedded therein a plurality of discrete structures comprising a second amorphous material, each of the discrete structures having a size in at least one dimension substantially smaller than an effective wavelength of light in the second material,

wherein the first material has a first index of refraction and the second material has a second index of refraction different from the first index of refraction by at least $\Delta n = 0.5$, and

wherein the size of the discrete structures in the at least one dimension is different in a first local region of the body than in a second local region of the body, thereby providing a graded index of refraction.

Claims 2-3 (Withdrawn).

4. (Previously presented) The light transforming device of claim 1, wherein the discrete structures include grains having a size in three dimensions that is substantially smaller than an effective wavelength of light in the second material.

Claims 5-9 (Withdrawn).

10. (Currently amended) A light transforming device having a graded index of refraction, comprising:

a plurality of alternating layers of a first amorphous material having a thickness and a second amorphous material, each layer of the second material

having a thickness substantially less than an effective wavelength of light in the second material,

the first material having a first index of refraction,

the second material having a second index of refraction different from the first index of refraction by at least $\Delta n = 0.5$,

the plurality of alternating layers forming a light transforming medium with an effective index of refraction in a local region that depends on a local ratio of a volume of the layers of the first material to a volume of the layers of the second material,

wherein a graded effective index of refraction along a direction transverse to the layers is formed by varying the thicknesses of the layers.

11. (Previously presented) The light transforming device of claim 10, wherein the thickness of each layer of the second material is less than one-tenth the effective wavelength of light in the second material.

12. (Previously presented) The light transforming device of claim 10, wherein each layer of the first material has a thickness substantially less than an effective wavelength of light in the first material.

13. (Previously presented) The light transforming device of claim 12, wherein the thickness of each layer of the first material is less than one-tenth the effective wavelength of light in the first material.

14. (Previously presented) The light transforming device of claim 10, wherein the thickness of each layer is controlled to within 0.5 nm and the effective index of refraction is controlled to within 0.005.

15. (Previously presented) The light transforming device of claim 10, wherein at least one of the first material and the second material is an amorphous material.

16. (Previously presented) The light transforming device of claim 15, wherein the first material comprises silicon dioxide and the second material comprises tantalum pentoxide.
17. (Previously presented) The light transforming device of claim 15, wherein the first material comprises silicon dioxide and the second material comprises titanium dioxide.
18. (Previously presented) The light transforming device of claim 10, wherein the first material comprises silicon dioxide and the second material comprises silicon.
19. (Previously presented) The light transforming device of claim 10, wherein at least one of the first material and the second material is a polycrystalline material.
20. (Previously presented) The light transforming device of claim 10, wherein the layers are substantially planar.
21. (Withdrawn)
22. (Previously presented) The light transforming device of claim 10, wherein the graded effective index of refraction is a parabolic function of position along the direction transverse to the layers.
23. (Previously presented) The light transforming device of claim 10, wherein the device has a length such that light having a large mode size entering at a first end of the device and propagating longitudinally through the device is focused to a small mode size at a second end of the device.
24. (Previously presented) The light transforming device of claim 23, wherein the small mode size is less than 1 μm .
25. (Previously presented) The light transforming device of claim 10, wherein the device has a length such that light having a large mode size entering at a first end of

the device and propagating longitudinally through the device is focused to a small mode size at a focal point outside a second end of the device.

26. (Previously presented) The light transforming device of claim 10, wherein the small mode size is less than 1 μm .

27. (Previously presented) The light transforming device of claim 10, wherein the effective index of refraction varies such that a mode profile of light propagating through the device is transformed from a first mode profile substantially matching a mode profile for light propagating in a single mode fiber to a second mode profile substantially matching a mode profile for light propagating in a semiconductor waveguide.

28. (Previously presented) A light transforming device having a graded index of refraction, comprising:

a plurality of alternating layers of a first amorphous material having a thickness and a second amorphous material, each layer of the second material having a thickness substantially less than an effective wavelength of light in the second material,

the first material having a first index of refraction,

the second material having a second index of refraction different from the first index of refraction,

the plurality of alternating layers forming a light transforming medium with an effective index of refraction in a local region that depends on a local ratio of a volume of the layers of the first amorphous material to a volume of the layers of the second amorphous material, wherein a graded effective index of refraction along a direction transverse to the layers is formed by varying the thicknesses of the layers.

29. (Previously presented) The light transforming device of claim 28, wherein the thickness of each layer of the second material is less than one tenth the effective wavelength of light in the second material.

30. (Previously presented) The light y transforming device of claim 28, wherein the thickness of each layer is less than one-tenth the effective wavelength of light in the respective material.

31. (Previously presented) The light transforming device of claim 28, wherein the second index of refraction is different from the first index of refraction by at least 0.2.

32. (Previously presented) The light transforming device of claim 28, wherein the thickness of each layer is controlled to within 0.5 nm and the effective index of refraction is controlled to within 0.005.

33. (Previously presented) The light transforming device of claim 28, wherein the first material comprises silicon dioxide and the second material comprises titanium dioxide.

34. (Previously presented) The light transforming device of claim 28, wherein the first material comprises silicon dioxide and the second material comprises silicon.

35. (Previously presented) The light transforming device of claim 28, wherein the first material comprises silicon dioxide and the second material comprises tantalum pentoxide.

36. (Previously presented) The light transforming device of claim 28, wherein the layers are substantially planar.

37. (Withdrawn)

38. (Previously presented) The light transforming device of claim 28, wherein the graded effective index of refraction is a parabolic function of position along the direction transverse to the layers.

39. (Previously presented) The light transforming device of claim 28, wherein the device has a length such that light having a large mode size entering at a first end of the device and propagating longitudinally through the device is focused to a small mode size at a second end of the device.

40. (Previously presented) The light transforming device of claim 39, wherein the device has a length such that light having a large mode size entering at a first end of the device and propagating longitudinally through the device is focused to a small mode size at a focal point outside a second end of the device.

41. (Previously presented) The light transforming device of claim 39, wherein the small mode size is less than 1 μm .

42. (Previously presented) The light transforming device of claim 28, wherein the effective index of refraction varies such that a mode profile of light propagating through the device is transformed from a first mode profile substantially matching a mode profile for light propagating in a single mode fiber to a second mode profile substantially matching a mode profile for light propagating in a semiconductor waveguide.

43. (Withdrawn)